

THE SUBGENUS *OCHLEROTATUS* IN THE AUSTRALIAN REGION
(DIPTERA: CULICIDAE).

III. REVIEW OF THE VICTORIAN SPECIES OF PERKINSI AND CUNABULANUS SECTIONS
WITH DESCRIPTIONS OF TWO NEW SPECIES.

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(Seven Text-figures.)

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Synopsis.

Both sexes and larvae of *Aedes continentalis*, n. sp., and *Aedes waterhousei*, n. sp., are described. The male and larvae of *Aedes luteifemur* Edwards and *Aedes nivalis* Edwards, the larvae of *Aedes cunabulanus* Edwards and *Aedes andersoni* Edwards are described for the first time. The pupae of all species are figured. The notes on *Aedes camptorhynchus* (Thomson) are given. An account is given of the biology and distribution of all species. The relationship of reviewed species is discussed.

The present paper is one of a series on the subgenus *Ochlerotatus* initiated by E. N. Marks (1957, 1958). In that first paper Marks proposed a subdivision of the Australian species of the subgenus into nine sections on the structure of the male terminalia. Southern species of the Perkinsi and Cunabulanus Sections will be reviewed here.

Edwards (1932) stated that "most of the species of the subgenus *Ochlerotatus* inhabit temporary ground pools and are single brooded". Marks (1957) indicated that the larval and pupal periods are usually short and that the adults appear suddenly in large numbers and are a pest for a limited period only. Studies on the biology of Victorian species of this subgenus have revealed that these conclusions cannot be applied to most Victorian species. The appearance of adults depends on the time at which breeding places filled by rainfalls, character of pools and their situation. Development of larvae in shallow pools exposed to the sun proceeds much faster than in deeper pools shaded by trees. These factors prolong the duration of adult occurrence in nature. An apparent disappearance of adults often means not that they have died out but that they have changed their habits. Thus *Aë. andersoni* in the Grampians and *Aë. waterhousei*, which are day biting mosquitoes during the spring, bite only after sunset during the summer and early autumn.

Moreover, unseasonal, heavy summer rainfall can fill breeding places and produce a second generation of spring species in the summer. IV stage larvae and pupae of *Aë. waterhousei* have been recorded in back water pools in stream bed in late March at Steiglitz, Victoria. At Bogong High Plains larvae of all stages and pupae have been collected in early December (G. W. Douglas) and all stages except youngest larvae were present in permanent pools in mid-February. *Aë. camptorhynchus* breeds all the year round.

Larvae of *Aë. continentalis* and *Aë. andersoni* have not been collected during the summer, but biting adults of the first species have been recorded at Carpendeit in February and of the second species at Cape Otway and at the Grampians in March. It is hard to believe that these mosquitoes belonged to a spring generation; they were not rubbed and appeared to be recently emerged.

All the usual breeding places have been completely dry during the summer and it seems that they possibly continue to breed in some places which are difficult to locate. In South Australia, E. W. L. Lines (Marks, 1957) found that flooded rabbit

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burrows are an important breeding place of several species of mosquitoes. N. V. Dobrotworsky (1954) expressed the opinion (confirmed later) that some species of *Theobaldia* would be found to breed in subterranean waters in the tunnels of the land crayfish (*Engaeus* spp.). Thus the possibility is not excluded that above-mentioned species of *Aëdes* are able to breed in such places near creeks during the summer.

Biologically, the species reviewed in this paper have some common features: (1) The adults are most abundant during the spring; they are derived from larvae which have developed during the winter. (2) The eggs laid by that spring generation, on soil amongst decayed vegetation of dry or drying out pools, are able to survive the summer drought. (3) The eggs hatch after the breeding places are filled by rain water. (4) It is likely that all species given favourable conditions are able to produce one or more summer generations. (5) All species except *camptorhynchus* are confined to woodland areas with an average annual rainfall at least 16–18 inches.

The study of the morphological traits of the male terminalia as well as of the life histories revealed that a form of *cunabulanus* from the mainland is distinct, particularly on larval characters, from Tasmanian *cunabulanus*. This new form from the mainland is regarded as a distinct species which, on larval characters, is closer to *andersoni* than to *cunabulanus* and named *Aë. continentalis*, n. sp. *Aë. nivalis* appears to be a complex of several forms. One of these which is readily distinguished, particularly on the male characters, will be described below as *Aë. waterhousei*, n. sp. The form *andersoni*, which is common in the Grampians, and distinguished by the absence of a patch of broad scales in front of the wing roots, will be treated as a form with undecided taxonomic status.

AËDES LUTEIFEMUR Edwards.

Aëdes luteifemur Edwards, 1926, *Bull. Ent. Res.*, 17: 112.

Distinctive Characters. Adults: Scutum uniformly clothed with goldish scales, with admixture of some black ones. Hind femora ochreous, with more or fewer dark scales towards apex. Wing dark-scaled, becoming pale distally, particularly on C and R. Female tergites unbanded, IV–VII mottled with creamy scales. Sternites clothed with whitish scales, with some admixture of ochreous scales. Male terminalia: Coxite with numerous long setae along inner edge. Apical lobe of coxite prominent; basal lobe shelf-like, having on its margin one short stout seta and row of about 13 long setae, about 7 of them recurved. Larva: Head seta 5, 3–5-branched; 6, 2–4-branched. Prothoracic seta 1, 1–2-branched; 2 and 6, single; 3, 2–3-branched; 4 and 5, 2-branched. Lateral comb of 20–23 fringed scales with long central tooth. Siphon index 2.9–3.4.

Description of Adult. Male. Head: Vertex clothed with curved and forked creamy scales becoming dark towards neck. Small elongate patch of narrow curved bronzy scales close to posterior margin of eyes. Broad flat white scales laterally. Proboscis and palps black-scaled. Palps longer than proboscis (without labella) by half length of 5th segment. Thorax: Integument brown. Scutum uniformly clothed with goldish scales, with some admixture of black ones. Scutellum with pale narrow curved scales and strong goldish bristles, a few of them may be dark. Anterior pronotum with narrow pale scales, and pale and dark bristles. Posterior pronotum with small patch of elongate white scales below, a mixture of elongate dark and narrow curved pale scales medially, and narrow curved pale scales above. Post-spiracular area with patch of narrow curved and elongate pale scales. Two lower mesepimeral bristles. Legs: Fore and mid femora mottled with pale scales anteriorly, pale posteriorly; hind femur pale on basal three-quarters, black apically with mottling of pale scales. Knee spots small. All tibiae black anteriorly, and more or less pale posteriorly. Tarsi black, unbanded, with light mottling on 1st segment of fore and hind legs; a few pale scales at base of 2nd segment of hind legs. Claws of all legs with tooth. Wing length 4.6–5.2 mm. Cell R_2 about 1.2 times its stem. Wing scales dark brown, except those towards apex on C and R, which are paler. Abdomen: Tergites black-scaled, with some mottling of ochreous scales on VII and VIII, and white lateral spots. Sternites white-scaled, becoming ochreous towards apex of abdomen; segments with elongate

black median patch, and admixture of black and ochreous scales apically. Terminalia (Fig. 1, *a*, *b*, *c*): Coxite dark-scaled sternally and laterally, with a few pale scales at base, with numerous strong setae; dense long setae along inner edge of coxite. Tergally coxite bears short fine setae along its inner aspect, laterally and apically with long and strong setae. Apical lobe prominent with 10–15 setae. Basal lobe prominent, shelf-like, having on its margin one short stout seta and row of about 13 long setae, about 7 of them recurved apically; several long setae and numerous fine short setae on its upper surface. Style about as long as coxite, curved, with 2–3 fine preapical setae; terminal appendage almost straight. Harpago stout with a few short setae at base; appendage widening rapidly near half length and tapering towards tip. Paraproct with single tooth. Lobes of IXth tergite with 5–7 short stout setae.

Female. Female differs from male as follows: Palps about one-seventh length of proboscis, black-scaled with some pale scales. Proboscis more or less mottled. Forked scales on vertex mostly black, with only a few pale scales in middle. Black scales on scutum more numerous, particularly in fossa. Narrow curved scales in front of wing roots may become white. Most bristles on scutellum dark. Posterior pronotum with small patch of elongate and narrow curved white scales below, a few narrow curved pale scales above along border with scutum, and black scales medially. Usually 4 lower mesepimeral bristles. Wing length 4.6–5.9 mm. Cell R_2 2.2–2.4 times its stem. Number of pale scales along C and R variable. Legs: Hind femur pale on basal half, becomes ochreous towards apex, and always with admixture of some black scales towards apex, particularly on dorsal side. Some specimens have black stripe on apical one-third of femur. May be some pale scales at base of 2nd and 3rd segments of tarsi. Abdomen unbended, purplish-black scaled with increasing admixture of ochreous scales, usually from segment 4 or 5. Some specimens have admixture of ochreous scales on all tergites, but others have only on tergites 6 and 7. Sternites clothed with whitish scales, with admixture of some ochreous scales in middle and at apical angles of segments, segment 7 usually ochreous-scaled.

Description based on specimens from the following localities: Otway, Carpenteit, Baxter, Maroondah, Yellingbo, Lower Tarwin, Wilson's Promontory, Victoria.

The specimens from Tasmania have an integument much lighter than mainland specimens. The upright forked scales on vertex are mostly creamy; the golden scales on the scutum are pale and in some specimens almost white. The apical part of the hind femur is ochreous with only a few scattered black scales dorsally.

The specimens from Flinders I. are intermediate in some traits (integument, colour of forked scales on vertex, number of black scales on hind femur).

Larva (Fig. 1, *f*, *g*, *h*, *i*). Head, siphon and saddle light brown. Head about three-fifths as long as broad. Antennae slightly more than half length of head, with scattered spicules; seta 1 arising about mid-length of antenna, 7–9-branched. Head seta 4, tiny, 5–6-branched; 5, 3–5-branched; 6, 2–4-branched; 7, 6–12-branched; 8, single or 3-branched; 9, 2–3-branched. Mentum with 13–14 lateral teeth on each side. Thorax: Prothoracic seta 1, 1–2-branched; 2 and 6, single; 3, 2–3-branched; 4 and 5, 2-branched; 7, 3-branched. Abdomen: VIIIth segment: Lateral comb patch of 20–23 fringed scales, central tooth about twice as long as nearest lateral one. Seta 1, 5–8-branched; 2, single, may be 2-branched; 3, 8–11-branched; 4, single; 5, 6–9-branched. Siphon tapering towards apex; index 2.9–3.4, mean 3.1. Pecten of 21–24 spines with 3–4 denticles at base, distal one usually the largest. Seta 1 arising about halfway along siphon, 6–9-branched, slightly plumose. Anal segment: Saddle covering dorsal three-quarters of segment, it covered with short arched rows of fine spines; a small separate sclerotized plate lies near lower proximal angle of saddle. Seta 1, single; 2, 5–7-branched; 3, single; 4 (ventral brush), of 15–16 tufts, usually one precratal, but may be two. Ventral pair of anal papillae slightly shorter than dorsal one, all pointed, less than half length of saddle.

Pupa. Details shown in Figure 1, *j*, *k*.

Biology. *Aë. luteifemur*, which is one of the most common spring species, breeds in clean rain water pools more or less exposed to the sun. Pools may be with or

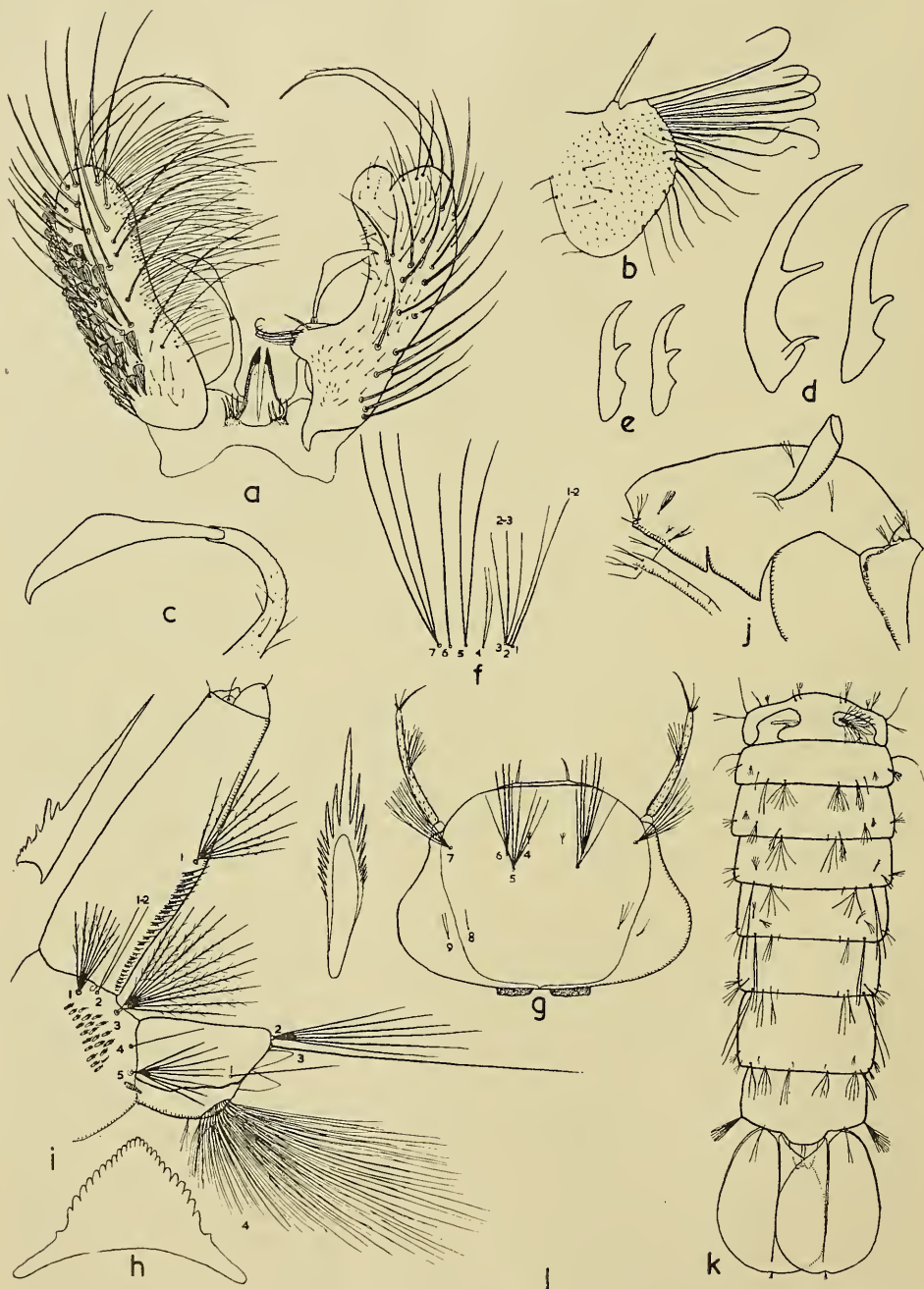


Fig. 1.—*Aedes luteifemur* Edwards. *a-c*, ♂ terminalia: *a*, left coxite sternal aspect, right coxite tergal aspect; *b*, basal lobe; *c*, harpago; *d-e*, ♂ tarsal claws: *d*, fore; *e*, hind; *f-i*, larva: *f*, prothoracic setae; *g*, head; *h*, mentum; *i*, terminal segments; *j-k*, pupa: *j*, cephalothorax and metanotum; *k*, abdomen.

without vegetation and from a few inches to 2-3 feet deep, and often having decayed leaves on the bottom. The breeding places are usually confined to sparse woodlands; in more heavily timbered country this species is confined to cleared patches where it breeds in pits made by uprooted trees. The eggs hatch immediately after the breeding places become filled by rain water. The adults usually appear in September and have been collected as late as 5th March. A second, summer generation can develop in favourable conditions. Larvae have been associated with *alboannulatus*, *queenlandis*, *waterhousei*, *calcariae*, *flavifrons*, *purpuriventris*.

Biting habits. It is a day biting mosquito attacking man, rabbits and birds (hen). Its biting activities are restricted mainly to the vicinity of the breeding places.

Distribution. It is confined to woodlands, mainly in plain or low hills country, and has not been collected at altitudes greater than 2,000 feet. Specimens have been examined from the following localities: VICTORIA: Cabbage Tree Creek, Foster, Fish Creek, Wilson's Promontory, Tarwin Lower, Cranborne, Mornington Peninsula, Baxter, Maroondah, Healesville, Yellingbo, Woori Yallock, Ringwood, Anglesea, Cape Otway, Gorae West, Timboon, Drik Drik, Ballan, Lyonville, Grampians, Carpendeit (N. V. Dobrotworsky); Lady Barron, Flinders I. (F. N. Ratcliffe and D. L. McIntosh); TASMANIA: Lake St. Clair (S. G. Anderson).

AËDES WATERHOUSEI, n. sp.

Types. The type series was bred from larvae and pupae collected at Wattle Glen, Victoria: Holotype male and allotype female 8.9.55, nine paratype males and nine paratype females 25.4.54, 3. and 8.9.55, 5.1.55, 26.9.57 and 3.11.58. The holotype, two paratype males, the allotype and nine paratype females have their associated larval and pupal skins. The holotype male, allotype female, four paratype males and four paratype females are in the collections of the National Museum, Melbourne. One paratype male and one paratype female are in each of the following collections: C.S.I.R.O., Division of Entomology, Canberra; School of Public Health and Tropical Medicine, Sydney; University of Queensland, Brisbane; British Museum (Natural History), London; U.S. National Museum, Washington.

This species is named after Mr. E. J. Waterhouse, C.S.I.R.O., Wildlife Survey Section, whose extensive collections and studies of the breeding places in the Armidale area of N.S.W. have contributed much to an understanding of the taxonomic status of the *nivalis* complex.

Distinctive Characters. Male: Hind femur pale on basal three-quarters. Tergites black-scaled, with white basal bands. Coxite with large number of long setae directed mesially. Basal lobe of coxite shelf-like, having on margin one short stout seta and row of 11-13 long setae, 7-8 of them recurved. Female: Scutal scales mesially, particularly between dorso-central bristles, narrow, straighter, bronze. Tergites 2-3 with basal white bands convex posteriorly. Tarsi unbanded. Larva: Head seta 6, usually 2-branched. Prothoracic seta 1, 2-branched; 2, 4 and 6, single; 3, 2-4-branched; 5, 2-3-branched; 7, 3-branched. Spines from lateral comb fringed at base; central tooth 3-4 times longer than longest lateral one. Siphon index 2.6-3.0. Anal papillae narrow, about as long as length of saddle.

Holotype Male. Head: Vertex clothed with curved and forked creamy scales; elongate patch of narrow curved bronzy scales close to posterior margin of eyes. Broad white scales laterally with central patch of dark scales. Palps slightly longer than proboscis (including labella), black-scaled; hairs on apex of segments 3 and 4, long, dark. Proboscis black-scaled. Thorax: Integument dark brown. Scutal scales narrow curved. Those scales mesially between dorso-central bristles, inner half of fossa and lateral areas, narrower, straighter, dark bronze. Outer part of fossa, margin of lateral area, and area round prescutellar bare area, clothed with larger pale scales. Scutellum with narrow curved pale scales. Anterior pronotum with narrow curved pale scales, pale and dark bristles. Posterior pronotum with a few elongate pale scales below, curved and elongate dark scales medially, and curved pale scales above. Post-spiracular area with patch of elongate and narrow curved white scales and pale bristles. 2-3 lower

mesepimeral bristles. Legs: Fore and mid femora dark above, and mottled with white scales, basal three-quarters pale below. Hind femora pale on basal three-quarters, dark-scaled on dorsal one-quarter, with some mottling anteriorly. All tibiae dark-scaled, with some pale scales. Tarsi unbanded. Wing length 4.5 mm., black-scaled. Cell R_2 1.1 times its stem. Abdomen: Tergites dark-brown-scaled. Basal white bands broken in middle but joining white lateral spots. Venter white-scaled with black elongate central patch and apical lateral patches. Terminalia (Fig. 2, *a*, *b*, *c*): Coxite dark-scaled sternally and laterally, with a few pale scales at base, with numerous long setae directed mesially, and a number of strong, long setae scattered along distal one-third, 5-6 being particularly strong and long. Tergally coxite bears a few small setae on its basal half or two-thirds, long setae laterally and distally. Apical lobe prominent with several fine setae. Basal lobe shelf-like, with several fine setae on its upper surface, having on its margin one short stout seta, and row of 11-13 long setae, 7-8 of them recurved apically. Style slender, curved tapering on distal third, with 3 preapical setae; appendage slender, almost straight. Harpago with a few moderately strong setae, appendage blade-like, expanding gradually at mid-length and then tapering to curved tip. Paraproct with single tooth. Lobes of IXth tergite with 4-7 strong short setae.

Allotype Female. Differs from the male as follows: Head: Patch of narrow curved bronzy scales close to posterior margin of eyes larger than in male. Palps one-quarter length of proboscis, black-scaled with a few pale scales. Five lower mesepimeral bristles. Wing length 5.5 mm. Cell R_2 1.9 times its stem. Legs with conspicuous knee spots. Tibiae paler underneath. First segment of all tarsi with pale scales basally. Tergite 1, with pale scales; 2-6, with basal white bands convex posteriorly. Peak of triangular band on segment 6 almost touching apical border. Black median patches on sternites as long as half length of segment, apical lateral black spots small.

Paratype Females. The chief variations shown in a series of 9 females are: Some have two narrow lines of goldish scales along acrostichal bristles and along borders of lateral area of scutum. The mottling of black apical part of hind femora is variable. Wing length 5.0-5.5 mm. Basal bands on tergites may be reduced to small triangular patches. Some specimens have an irregular mesial patch of creamy scales on tergites 2-6; others have two such patches mesially on tergites 3-4.

Larva (Fig. 2, *d*, *e*, *f*, *g*). Head, siphon and saddle dark brown. Head about three-quarters as long as broad. Antenna about half length of head, spiculated; basal quarter light brown, distal three-quarters darker. Seta 1, 6-8-branched. Head seta 4, tiny, 3-5-branched; 5, usually 3-branched, rarely 4; 6, usually 2-branched, rarely 3; 7, 5-8-branched; 8, usually single, may be 2-branched; 9, 2-branched. Mentum with small central tooth and 11-12 lateral teeth on each side. Thorax: Prothoracic seta 1, 2-branched; 2, 4 and 6 single; 3, usually 3-branched, rarely 2 or 4; 5, 2-3-branched; 7, 3-branched. Abdomen: VIIIth segment: Lateral comb patch of 20-29 spines, fringed at base; central tooth 2-3 times longer than longest lateral tooth. Seta 1, 4-6-branched; 2 and 4, single; 3, 7-11-branched; 5, 4-6-branched; seta 1, 3 and 4 plumose. Siphon almost cylindrical up to distal spine of pecten, then tapering towards apex; index 2.6-3.0, mean 2.8. Pecten on basal half of siphon, of 21-30 spines, mean 25; spines at base with 4-5 teeth. Seta 1, 7-9-branched. Anal segment: Saddle covering dorsal three-quarters of segment and covered with short arched rows of fine spines; a small separate sclerotized plate lies near lower proximal angle of saddle. Seta 1, single, about as long as saddle; 2, 4-7-branched; 3, single; 4 (ventral brash), of 18-19 tufts, may be one precratal tuft. Anal papillae narrow, about as long as length of saddle.

Pupa. Details shown in Figure 2, *h*, *i*.

Biology. In New South Wales larvae have been collected in the Armidale area (E. J. Waterhouse) at heights of 2,800-4,700 feet from August until the end of October. They were breeding in pools with cloudy water, with or without vegetation, usually exposed to the sun. Usually the pools were shallow, but some were up to three feet deep. The breeding sites were situated mostly in the open, but sometimes amongst white gums or along gullies near the edge of forests.

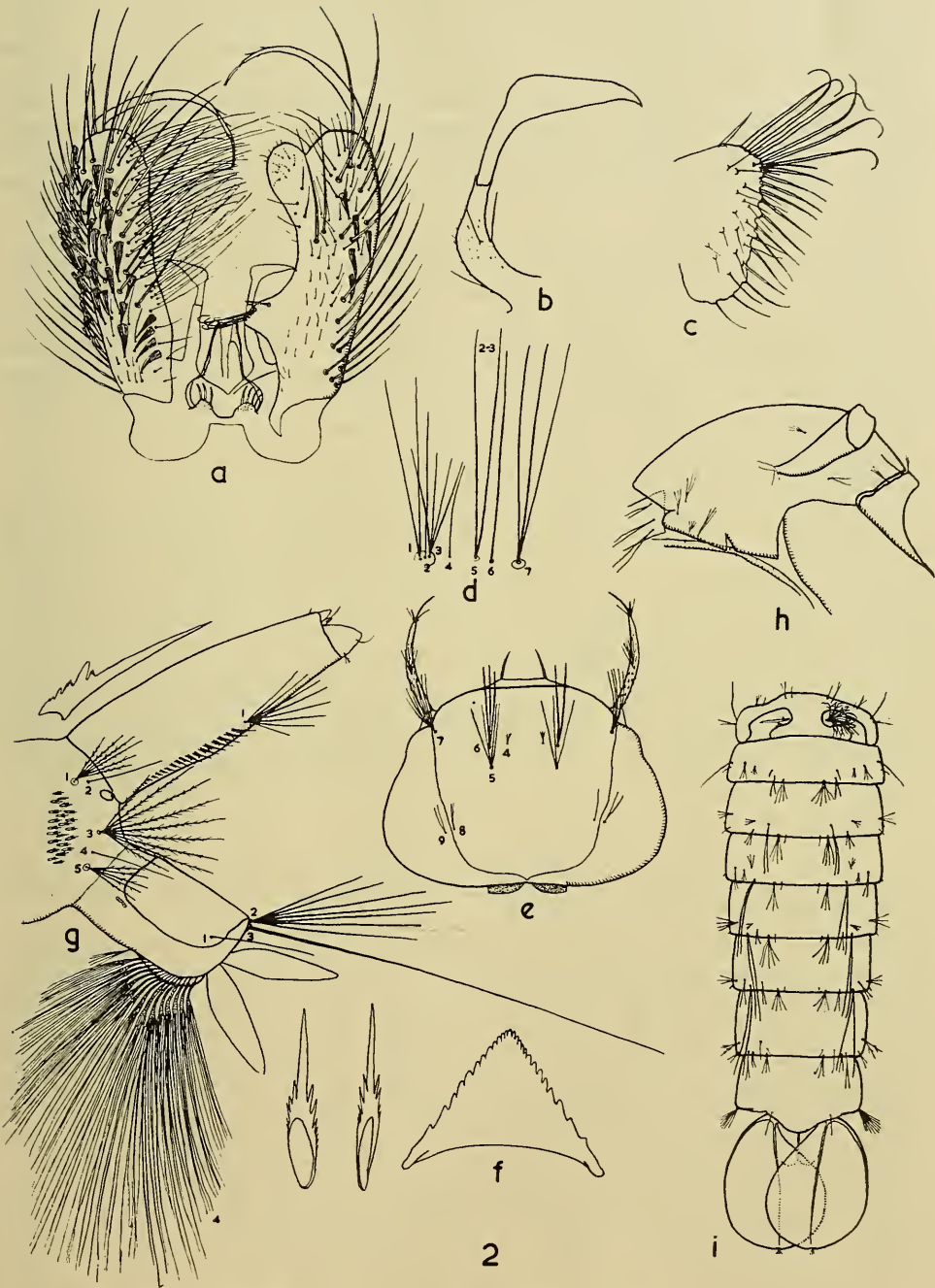


Fig. 2.—*Aedes waterhousei*, n. sp. a-c, ♂ terminalia: a, left coxite sternal aspect, right coxite tergal aspect; b, harpago; c, basal lobe; d-g, larva: d, prothoracic setae; e, head; f, mentum; g, terminal segments; h-i, pupa: h, cephalothorax and metanotum; i, abdomen.

In Victoria this species breeds in elevated country at altitudes up to 2,500 feet, but also spreads down to flat woodland country; it has been collected north-west of Horsham (G. W. Douglas). Although *waterhousei* is confined to woodland it avoids completely shaded pools in dense forests. Shallow valleys or plains with sparse bush are also favoured breeding sites of this species. The larvae have frequently been found in pools 1-3 feet deep with clear or cloudy water. In most places *waterhousei* has only one generation per year. Larvae hatch immediately after adequate autumn-winter rains, and usually complete their development during September-October. An additional summer generation is possible when heavy summer rains fill breeding places. At Steiglitz fourth stage larvae and pupae have been collected in backwater pools in creek beds late in March.

In New South Wales *Aë. waterhousei* was associated with larvae of *Aë. nivalis*, *alboannulatus*, *sagax*, *milsoni*; in Victoria with *Aë. queenslandis*, *alboannulatus*, *luteifemur*, *inconspicua* and *Aë. (Pseudoskusea)* sp.

Time of appearance of adults depends on weather conditions and may occur as early as August. September is the more usual time, and adults then remain numerous until November. In New South Wales biting adults have been recorded at 3,300 feet in March (Armidale, E. J. Waterhouse). In Victoria this species has also been recorded biting in the autumn, but only after sunset, at Grampians early in March.

Biting Habits. *Aë. waterhousei* is a day biting species which is very numerous near its breeding places. During hot dry weather it bites only after sunset.

Distribution. Distribution of *Aë. waterhousei* sometimes overlaps that of *Aë. nivalis*, but it does not occur at such high altitudes as the latter species; it is apparently absent from Barrington Tops, Mt. Kosciusko and Bogong High Plains. On the other hand *waterhousei* occurs at lower altitudes and has a much wider distribution. It seems that this species is not common either in South Australia or Tasmania. Specimens have been examined from the following localities: N.S.W.: Colo Vale (A. K. O'Gower), W. Uralla, "Robert" Uralla, Ben Lomond (E. J. Waterhouse), Urana (G. W. Douglas); A.C.T.: Condor Creek (J. F. Hill); VICTORIA: Tubbut (E. Bass), Warrandyte, Christmas Hills, Ringwood, Wattle Glen, Steiglitz, Euroa, Ballan, Lyonville, Grampians, Stawell, Cavendish, Armstrong, Ararat, Barkley (N. V. Dobrotworsky), Boto, Maryvale (G. W. Douglas); S.A.: Mt. Torrens (E. W. L. Lines), Belair Nat. Pk. (G. F. Gross); TASMANIA: Hobart (G. H. Hardy).

AËDES NIVALIS Edwards.

Culex australis, Theobald, 1911 (not Erichson, 1842), *Mon. Cul.* II: 91. *Aëdes nivalis* Edwards, 1926, *Bull. Ent. Res.*, 17: 112.

Distinctive Characters. Adults: Male with hairs but no scales on tergites, except for lateral patches of white scales. Terminalia: Coxite with numerous long setae along inner edge directed mesially; tergally with 5 or 6 long strong setae arranged in a row directed to base of apical lobe. Basal lobe shelf-like, having on margin one short stout seta, one long stout recurved seta and 4-6 finer setae, 3 or 4 of them with recurved tips. Female: Scutum clothed with narrow golden scales. Hind femora pale on basal two-thirds, black apically; tarsi unbanded. Tergites black-scaled with basal bands almost straight. Larva: Head seta 5 and 6, usually 3-branched. Prothoracic setae: 1, 2-branched; 2 and 6, single; 3, 2-5-branched; 4, single or 2-branched; 5, 2-3-branched. Lateral comb patch of 18-27 spines fringed at base; central tooth usually 3-4 times longer than longest lateral one. Siphon index 2.6-3.6. Pecten of 20-26 spines. Anal papillae narrow, longer than saddle. Larva sometimes cannot be distinguished from that of *waterhousei*.

Description of Adult. Male. Head: Vertex clothed with curved and forked creamy scales, latter becoming black towards neck. Broad flat white scales laterally with central patch of dark scales. Elongate patch of narrow curved bronzy scales close to posterior margin of eyes. Palps as long as proboscis including labella, black-scaled. Proboscis black-scaled. Thorax: Integument dark reddish-brown. Scutal scales narrow

curved golden, but broader and paler in front of wing roots and around prescutellar bare area; a few small black scales scattered on scutum. Scutellum with curved narrow pale-golden scales. Anterior pronotum with narrow curved pale-golden scales and bristles, latter becoming black dorsally. Posterior pronotum with patch of elongate white scales below, narrow curved goldish and black scales medially, and pale goldish scales above. Post-spiracular area with patch of broad, and narrow curved white scales and a few bristles. 3-4 lower mesepimeral bristles. Legs: Fore and mid femora dark above with some mottling, pale for three-quarters length below. Hind femur pale on basal two-thirds, black apically with a few scattered white scales. Wing length 4.3-5.6 mm., black-scaled. Cell R_2 1.1 times its stem. Abdomen: Tergites black, hairy, without dark scales, with only lateral patches of white scales. Venter white-scaled with large median black patch and black apical border to segments. Terminalia (Fig. 3, *a, b, c*): Coxite dark-scaled laterally and sternally. Sternally coxite bears numerous long setae directed mesially, several strong long setae scattered along coxite, 5 or 6 most distal of them strongest and longest. Tergally coxite bears numerous small setae on its basal two-thirds, long setae laterally and distally, and level with apical lobe, a row of 5-6 long strong setae. Apical lobe large with several fine setae. Basal lobe shelf-like, upper surface bears several fine setae having on margin one short stout seta, one long stout recurved seta and 4-6 finer setae, 3-4 of them with recurved tips. Style slender curved, tapering on distal one-third with 2-3 preapical setae and numerous minute setae below; appendage slender, slightly curved. Harpago stout curved, with a few moderately strong setae on basal half; appendage blade-like, expanding gradually towards mid-length and then tapering towards curved tip. Paraproct with single tooth. Lobes of IXth tergite with 3-6 short strong setae.

Female. Female differs from the male as follows: Palps one-fifth length of proboscis, black-scaled, with a few pale scales. Posterior pronotum may be clothed mainly with pale scales and have only a few black scales medially. 4-5 lower mesepimeral bristles. Wing length 4.0-6.0 mm. Cell R_2 1.8-2.0 times its stem. Legs with conspicuous knee spots. Tergites black-scaled; segments 1-2, with patch of white scales; 3-4, with incomplete basal band; 6-7, with band joining lateral patches. Segments 3-7 may have complete basal bands. Sternites with central and apical lateral patches of black scales.

Larva (Fig. 3, *d, e, f, g, h, i*). Head, siphon and saddle dark brown. Head about four-fifths as long as broad. Antenna about half length of head, spiculated, basal one-quarter light brown, distal three-quarters dark, almost black, may be lighter towards tip. Seta 1, 5-6-branched. Head seta 4, tiny, 2-5-branched; 5, usually 3-branched, rarely 4-branched; 6, usually 3-branched, rarely 2- or 4-branched; 7, 5-9-branched; 8, single; 9, usually 2-branched, rarely single. Mentum with small central tooth and 11-13 lateral teeth on each side. Thorax: Prothoracic seta 1, 2-branched, rarely 3-branched; 2 and 6, single; 3, 3-4-branched, may be 2- or 5-branched on one side; 4, usually single, rarely 2-branched; 5, 2-3-branched; 7, 3-branched. Abdomen: VIIIth segment: Lateral comb patch of 18-27 slender spines fringed at base. Central tooth 3-4 times as long as longest lateral tooth. Seta 1, 4-7-branched; 2 and 4, single; 3, 8-11-branched; 5, 8-7-branched. Seta 1 and 3 plumose. Siphon almost cylindrical from base up to seta 1, then tapering towards apex; index 2.6-3.6, mean 3.0. Pecten extending about half of length of siphon, with 20-26 spines, each with 3-4 small and one larger denticles at base. Seta 1, 6-8-branched. Anal segment: Saddle covering dorsal half of segment; surface with fine spines arranged in short arched rows. Small separate chitinized plate near lower proximal angle of saddle. Seta 1, single; 2, 5-8-branched; 3, single; 4 (ventral brush), of 16-17 tufts, one sometimes precratal. Anal papillae narrow, longer than saddle.

Description of adults and larva based on specimens collected at Marysville, Victoria (type locality).

Pupa. Details shown in Figure 3, *k, l*.

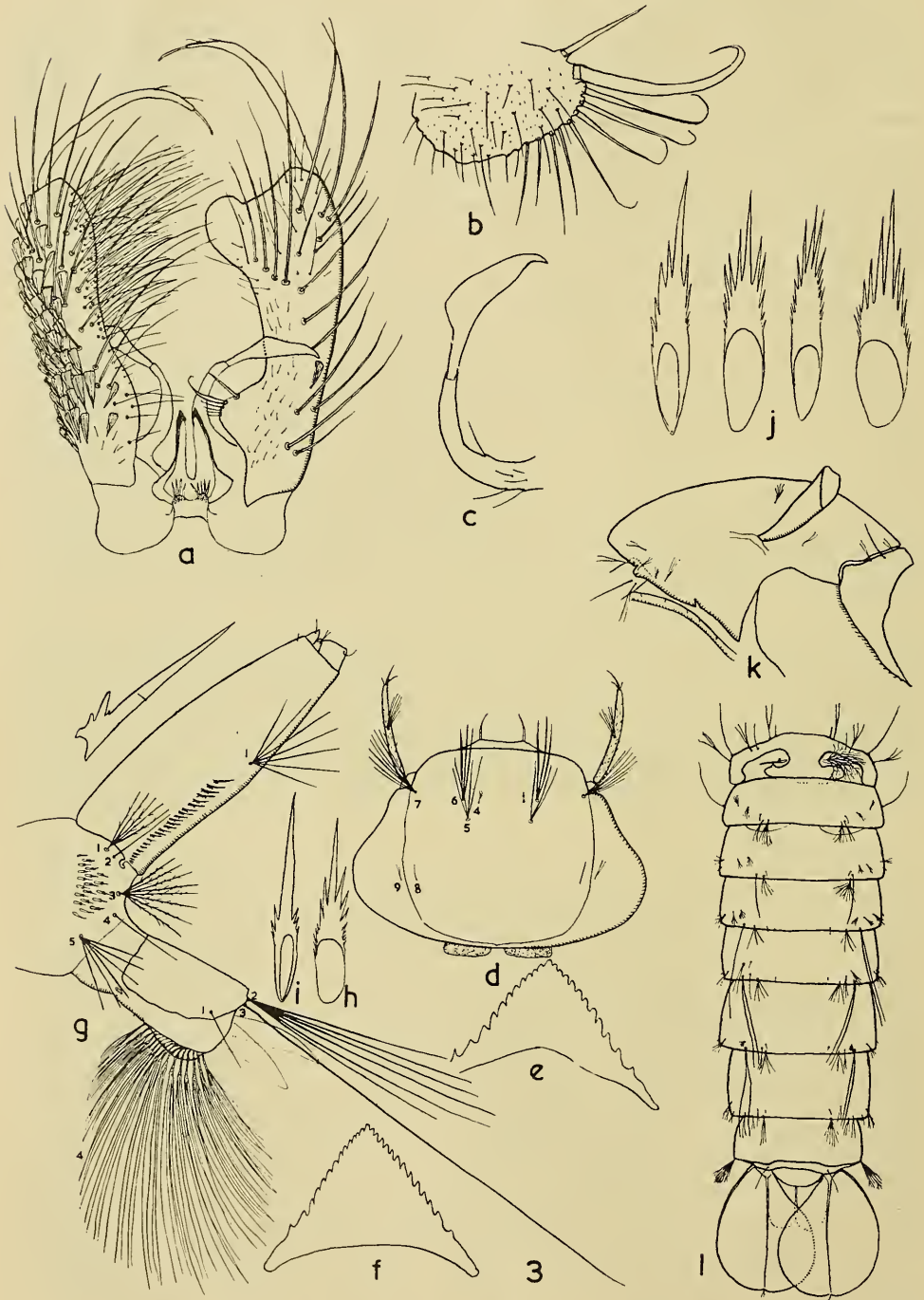


Fig. 3.—*Aedes nivalis* Edwards. *a-c*, ♂ terminalia: *a*, left coxite sternal aspect, right coxite tergal aspect; *b*, basal lobe; *c*, harpago; *d-j*, larva: *d*, head; *e*, mentum of larva from Marysville; *f*, mentum of larva from Lyonville; *g*, terminal segments; *h-j*, lateral comb teeth: *h*, from Marysville; *i*, from Lyonville; *j*, from Bogong; *k-l*, pupa: *k*, cephalothorax and metanotum; *l*, abdomen.

Bogong form of *AËDES NIVALIS*.

Specimens of *Aë. nivalis* from Bogong High Plains agree in general with *nivalis* from the type locality, but are smaller (wing length of the males 4.2–5.2 mm., the females 4.1–5.0 mm.) and darker. There are some differences in morphological traits of the larva: prothoracic seta 1 has 3–8 branches, with mean of 5 branches, whereas in larvae from other populations it has only 3–4 branches. The scales of the lateral comb are highly variable; they may have a single central tooth three times longer than the nearest lateral one or three long central teeth almost equal in size (Fig. 3, j).

Biology. *Aë. nivalis* is confined mainly to elevated country and rarely descends to the plains. In New South Wales it has been recorded at Barrington Tops at 5,000 feet (I. M. Mackerras, 1927), Mt. Kosciusko 6,000 feet (L. E. Cooling, 1924) and was recently collected in the Armidale area (E. J. Waterhouse) at 3,300–4,800 feet. Here in 1955 larvae were found during August and September in pools usually exposed to the sun, with or without vegetation, mainly in water cloudy with colloidal clay suspension. Adults were collected until March. In Victoria it breeds usually at altitudes higher than 2,000 feet, mainly in shallow pools with decayed leaves, but also in deeper ones 2–3 feet deep. The pools are usually exposed to the sun or to dispersed light; only once have larvae been collected from a shaded pool. Water in pools was clear or cloudy. Although *nivalis* is associated with woodland, it avoids dense forests with deep shade and is confined to the sparse patches of bush or clearings. The Bogong form breeds on High Plains at altitudes 5,300–5,400 feet in pools 1–2 feet deep exposed to the sun.

It seems likely that in most localities *nivalis* has only one generation a year, because the breeding places remain dry during summer months, but the Bogong form breeds continuously in permanent pools during the summer, and passes winter in the larval stage under ice. Laboratory experiments have shown that larvae survive in iced water at 0°C., but die at –4°C., in solid ice.

At higher altitudes, e.g. Marysville (3,000–3,200 feet), the larvae did not complete their development before the end of November, and in the Mt. Buller area (4,000 feet) larvae have been collected late in December. At lower altitudes (Lyonville) larval development usually is completed not later than the end of October.

In New South Wales *Aë. nivalis* larvae were associated with *Aë. waterhousei* and *alboannulatus*; in Victoria also with *queenslandis* and at Lyonville sometimes with *flavifrons*, *purpuriventris*, *calcariae* and *T. inconspicua*.

Distribution. *Aë. nivalis* is distributed along the Great Dividing Range from the north of New South Wales (Ben Lomond) to the Grampians in Victoria. It reaches the highest altitudes at Mount Kosciusko (6,000 feet). It has also been recorded in Tasmania. Specimens from the following localities have been examined: N.S.W.: Barrington Tops 16.1.34 (I. M. Mackerras?); "Walsh" Ben Lomond 12.9.55, Ben Lomond 3.3.56 (E. J. Waterhouse); Colo Vale 16.10.56 (W. Wirth); 20.11.57 (J. C. Towitsh); Mt. Kosciusko 31.12.33 (I. M. Mackerras); Ebor 16.10.50. VICTORIA: Bogong High Plains 6.12.56 (G. W. Douglas); 13.2.58 (N. V. Dobrotworsky); Mt. Buller area 19.12.58, Marysville 14.11.57, 25.11.58, Trentham 27.10.57, Ballan 11.10.56, Lyonville 14.12.54, 19.10.55, 19.11.55, 13.9.56, Mt. Victory (Grampians) 26.9.58 (N. V. Dobrotworsky).

AËDES CAMPTORHYNCHUS (Thomson).

Culex camptorhynchus Thomson, 1868, *Eugenies Resa*, Dipt. 443. *Culex labeculosus* Coquillett, 1906, *Ent. News*, 16: 116. *Culicelsa westralis* Strickland, 1911, *Entom.*, 44: 131. *Culicada inornata* Strickland, 1911, *Entom.*, 44: 201. *Culicada annulifer* Taylor, 1913, *Trans. Ent. Soc. London*, 693. *Culicada victoriensis* Taylor, 1914, *Proc. Linn. Soc. N.S.W.*, 39: 400. *Culicada nigra* Taylor, 1914, *Trans. Ent. Soc.*, 688.

Distinctive Characters. Adults: Wing dark-scaled. Femora, tibiae and first tarsal segment mottled with white scales. Tarsi banded. 2–3 lower mesepimeral bristles. Tergites with white basal bands; female with convex basal bands. Male terminalia: Coxite with prominent apical lobe and moderate basal lobe. Basal lobe having on margin one short stout seta, one long stout recurved seta and 6–11 shorter and finer straight

setae. Larva: Head seta 5, 3-4-branched; 6, 2-3-branched. Prothoracic setae: 1, 2-branched; 2, 4, 5 and 6, single; 3, 2-4-branched; 7, 2-4-branched. Comb of 24-33 fringed scales. Siphon index 2.0-2.3. Anal papillae very small rounded.

Description of Adult. Male. Head: Vertex usually clothed with narrow curved and forked pale scales; latter may be dark laterally and towards neck. Lateral scales broad white except for dark patch. Proboscis entirely black-scaled or with a few pale scales. Palps as long as proboscis, dark-scaled, with white scales at base of segments 2, 4 and 5. Antenna with long pale lustrous hairs. Thorax: Integument dark brown. Scutum uniformly clothed with narrow curved dark golden scales or light golden in some specimens. One or two pairs of whitish patches on scutum about half-way from front edge. Posterior pronotum with patch of moderately broad white scales below, narrow dark scales medially and above; in some specimens broad white scales tend to replace dark ones. Post-spiracular area with patch of broad scales. 2-3 lower mesepimeral bristles. Legs: Femora, tibiae and 1st tarsal segments mottled. White basal bands on tarsal segments 2 and 3 of fore leg, 2, 3 and 4 of mid leg and 2-5 of hind leg. All claws with tooth (Fig. 4, c, d). Wing length 4.0-5.0 mm. Cell R_2 about 1.5 length of its stem. Abdomen: Tergites black-scaled, segment 2 with patch of white scales, 3-7 with basal white bands. Sternites white-scaled with central and lateral apical patches of black scales. Terminalia (Fig. 4, a, b): Sternally coxite bears numerous long mesially directed setae. Apical lobe prominent with several moderately long setae; basal lobe moderate, having on margin one short stout seta, one long stout recurved seta and 6-11 short, finer straight setae; upper side of lobe usually with numerous moderately long setae. Appendage of harpago narrow on basal two-thirds then sharply expanding and then tapering towards tip.

Female. Differs from male as follows: Elongate patches of narrow bronzy scales close to posterior margin of eyes. Torus dark mesially with a few pale scales and black bristles. Palps one-fifth length of proboscis, mottled. Proboscis extensively mottled, often almost completely pale-scaled. 3-4 lower mesepimeral bristles. White bands on 2-5 tarsal segments of all legs. Wing length 3.4-5.2 mm. Cell R_2 about 2.5 its stem. Usually patches of white scales on tergites 1-2, and convex bands on tergites 3-6, but these bands may be either narrow and almost straight or triangular, sometimes with apex reaching posterior margin of tergites. Patch of black scales on sternites may be reduced to a few scales.

Larva (Fig. 4, e, f, g). Head seta 4, tiny, 5-7-branched; 5, 3-4-branched; 6 and 9, 2-3-branched; 7, 8-9-branched; 9, single or 2-branched. Mentum with small central tooth and 9-10 lateral teeth on each side. Prothoracic setae: 1, 2-branched; 2, 4, 5 and 6, single; 3 and 7, 2-4-branched. Abdomen: VIIIth segment: Lateral comb patch of 24-33 fringed scales; scales without long central tooth. Seta 1, 4-5-branched; 2 and 4, single; 3, 7-8-branched; 5, 5-6-branched. Siphon with index 2.0-2.3; pecten of 22-24 spines, each with 3-4 denticles at base; seta 1, 7-8-branched. Anal segment: Saddle covering about half of segment; seta 1 and 3, single; 2, 6-7-branched; 4, of 18-19 tufts, usually 2 of them precratal. Anal papillae very small rounded.

Biology. *Aë. camptorhynchus* breeds mainly in brackish swamps in open country, but it can be easily carried by winds into areas where brackish water is absent. In such conditions *camptorhynchus* breeds, more or less successfully, in freshwater swamps. This has been recorded in the Melbourne area (N. E. Kent, 1953), and at Violet Town (N. V. Dobrotworsky), more than 80 miles from the nearest brackish swamps; E. J. Britten (1958) frequently collected larvae of this species in fresh water in Western Australia.

In Victoria *Aë. camptorhynchus* remains active throughout the year. All larval stages, pupae and the emergence of adults have been observed on many occasions during the winter.

Biting Habits. It is an extremely vicious mosquito, which attacks during the day and particularly after sunset. It has been recorded as biting man, horses, cows and birds (ducks, hens).

Distribution. It is common in south-eastern, southern and south-western parts of Australia, and Tasmania. In Victoria it is not restricted to the coastal areas, but is permanently established inland where brackish waters occur. Thus in the Mildura area (about 225 miles from coast) *camptorhynchus* is a very common species.

AÈDES CUNABULANUS Edwards.

Aedes cunabulanus Edwards, 1923-24, *Bull. Ent. Res.*, 14: 378.

Distinctive Characters. Adult. Proboscis black-scaled. Scutum uniformly clothed with goldish narrow curved scales. Hind femora mottled. Male terminalia: Coxite without long dense mesially directed setae. Basal lobe of coxite shelf-like, having on its margin one short stout seta, 5-8 long setae with recurved tips, remainder straight and finer. Larva: Head seta 5, 4-5-branched; 6, 3-4-branched. Prothoracic setae: 1, 2-3-branched; 2 and 6, single; 3, 2-4-branched; 4, 5 and 7, 2-branched. Lateral

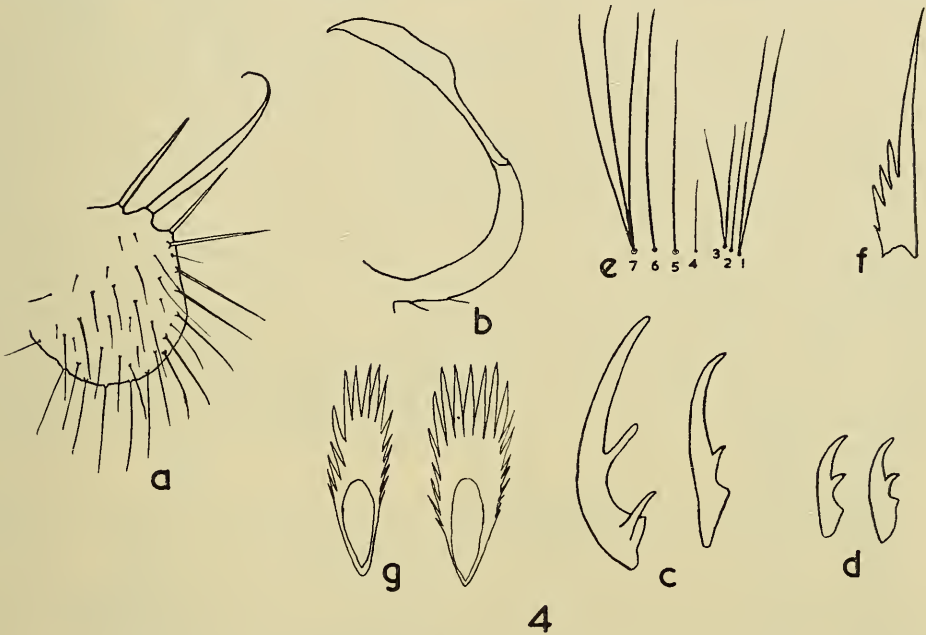


Fig. 4.—*Aedes camptorhynchus* (Thomson). *a-b*, ♂ terminalia: *a*, basal lobe; *b*, harpago: *c-d*, ♂ tarsal claws: *c*, fore; *d*, hind; *e-g*, larva: *e*, prothoracic setae: *f*, pecten tooth: *g*, lateral comb teeth.

comb patch of 28-32 fringed scales without long central tooth. Siphon index 2.9-3.2; pecten of 16-23 spines. Surface of dorso-distal part of saddle with fine spines arranged in arched rows.

Description of Adult. Male. Head: Vertex clothed with narrow curved and forked creamy scales, the latter becoming dark laterally and towards neck; lateral broad flat scales white with patch of black scales. Proboscis black-scaled. Palps black-scaled, slightly longer than proboscis without labella. Torus ochreous, black on medial aspect with a few black hairs and scales. Thorax: Integument reddish. Scutum uniformly clothed with narrow curved goldish scales, with a few dark bronze scales on fossa. Scutellum with narrow pale curved scales. Anterior pronotum with elongate white scales, pale and dark bristles. Posterior pronotum with elongate white scales below, elongate and narrow curved pale or goldish scales above. Single lower mesepimeral bristle. Legs: All femora mottled. Tibiae black anteriorly and with pale longitudinal stripe posteriorly; mid tibia slightly mottled. Tarsi black, unbanded; 1st tarsal segment of hind legs mottled. Wing length 4.1-5.6 mm. Cell R_2 about 1.7 times its

stem. Abdomen: Tergites black-scaled with white basal bands joining lateral spots. Sternites white-scaled, with median and apical lateral black patches on 2-7 sternites. Terminalia (Fig. 5, *a, b, c*): Coxite dark-scaled laterally and sternally with numerous long and short setae, only a few of the longer ones directed mesially. Apical lobe prominent with a few short setae. Basal lobe shelf-like, having on its margin one short stout seta, 5-8 long setae with recurved tips, remainder straight and finer. Style slender curved tapering, with 2-3 preapical setae; appendage slender almost straight. Harpago stout curved, with a few scattered setae; appendage narrow. Lobes of IXth tergite prominent with 3-5 short strong setae.

Female. Differs from male as follows: Palps one-fifth length of proboscis. Wing length 4.9-5.7 mm. Cell R_2 2.4-2.6 times its stem. Legs: Femora mottled, knee spots small, whitish. Tibia black with a few pale scales, which may form a line. Abdomen: 1st tergite with patch of dark and pale scales, 2-6 usually with incomplete bands, but bands on 4-6 may join lateral spots.

Larva (Fig. 5, *f, g, h, i*). Head siphon and saddle brown. Head four-fifths as long as broad. Antennae about three-fifths length of head, with scattered spicules; seta 1 arising at about mid length, 7-9-branched. Head seta 4, tiny, 3-4-branched; 5, usually 4- sometimes 5-branched; 6, 3-4-branched; 7, 3-9-branched; 8 and 9, single or 2-branched. Mentum with small central tooth and 11-12 lateral teeth on each side. Thorax: Prothoracic seta 1, 2-3-branched; 2 and 6, single; 3, 3-4-branched; 4, 5 and 7, 2-branched. Abdomen: VIIIth segment: Lateral comb patch of 28-32 scales; scales without odd long central tooth, usually with 2 or 3 equal in length. Seta 1, 4-7-branched; 2, 2-branched; 3, 9-14-branched; 4, single; 5, 4-7-branched. Setae 1 and 3 plumose. Siphon tapering beyond seta 1, index 2.9-3.2, mean 3.0. Pecten extending about two-fifths length of siphon of 16-23 spines; distal spines with 3-4 denticles at base. Seta 1, 7-branched. Anal segment: Saddle covering dorsal half, or slightly less, of segment, surface with fine spines arranged in arched rows. A small separate sclerotized plate near lower proximal angle of saddle. Setae 1 and 3, single; 2, 7-8-branched; 4 (ventral brush), of 15-16 tufts, 1 or 2 precratal. Anal papillae equal, pointed, slightly less than length of saddle.

Pupae. Details shown in figure 5, *j, k*.

Biology. Larvae of *Aë. cunabulanus* have been collected at Moth Creek, Port Davey District (E. N. Marks) and this is an abstract of Dr. Marks' observations:

"3rd and 4th instar larvae (mostly 4th) and pupae (there were a few pupal skins) were numerous in several prospect holes on 27.1.54. The holes were about 5' x 2' 6"-3' and 3-4' deep with 1' 6"-2' water in them; with sides of peaty soil and some overhanging sedges growing on ground surface. Some pools were more shaded than others. (There was no breeding in similar holes but with quartzite gravel lower sides and bottom). At one pool, several apparently gravid adults were disturbed on the upper part of the sides of the hole. It appeared that they might be seeking an oviposition site about 8-12 in. above the present water level. The pools are said to be usually practically full of water and never dry. Of these adults from the pool side, 2 were put in tubes over cotton wool. One was moribund and had laid 82 eggs by 9.15 next morning. The second had laid approximately 158 eggs on 28.1.54.

"The pools were re-examined on 7.2.54, 4 or 5 inches of rain having fallen since the earlier collection. There were still some 4th instar larvae and pupae and numerous 2nd instar larvae (presumably hatched from eggs submerged by the rise in waterlevel)."

The adults have been frequently collected during November-February (Edwards), 1926.

Distribution. Apparently it is a very common species in Tasmania, but only a single specimen, a female, has been collected on the mainland (Wilson's Promontory, 9.5.53, G. W. Douglas). Specimens from the following Tasmanian localities have been examined: Mt. Arthur, 28.12.15 (F. M. Littler), Gormanston, 28.1.48 (Key, Carne & Kerr); Moth Creek, 27.1.54 (E. N. Marks); Mt. Field Nat. Pk., 6.2.55 (T. E. Woodward).

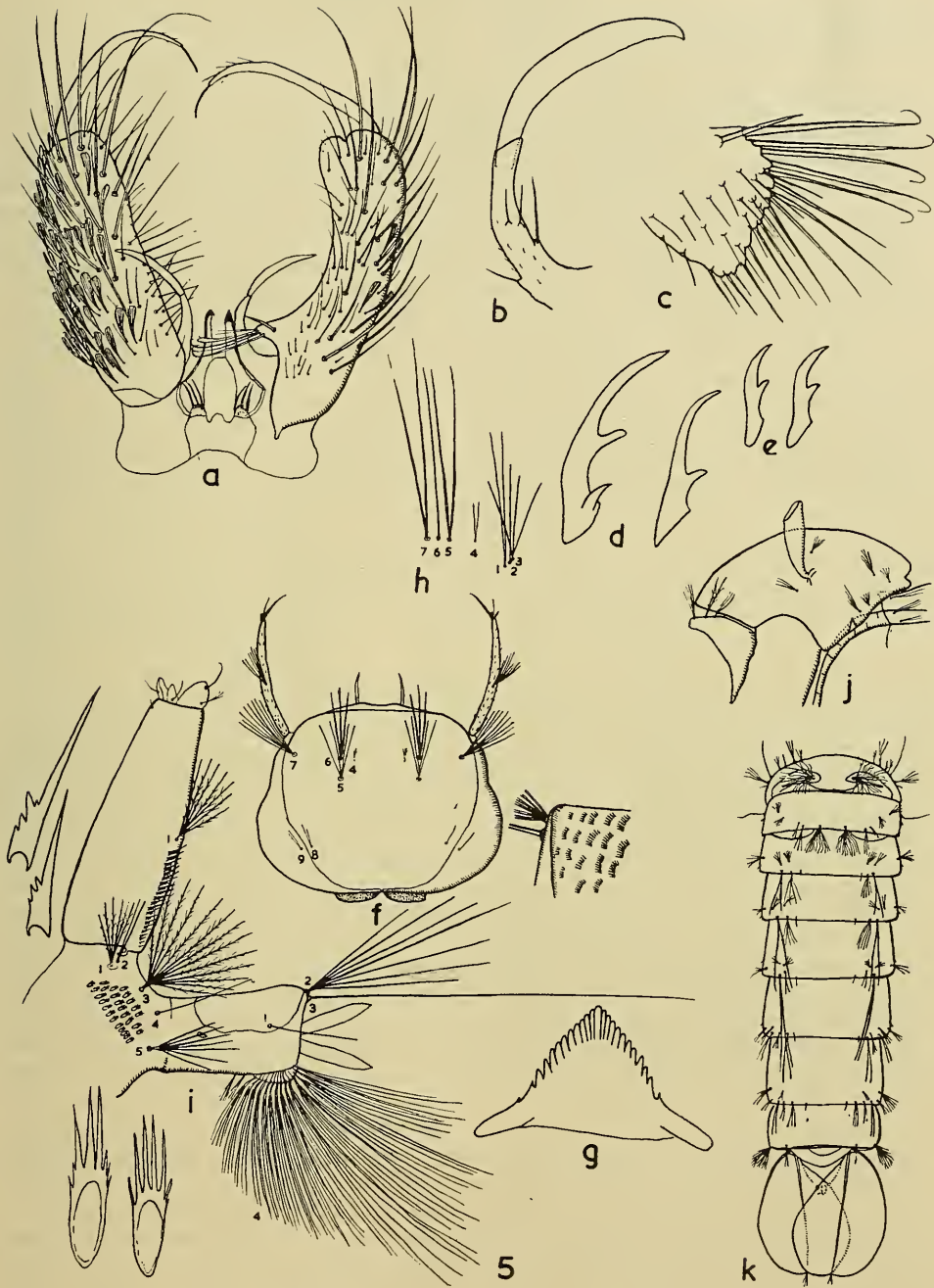


Fig. 5.—*Aedes cunabulanus* Edwards. a-c, ♂ terminalia: a, left coxite sternal aspect, right coxite tergal aspect; b, harpago; c, basal lobe; d-e, tarsal claws: d, fore; e, hind; f-i, larva: f, head; g, mentum; h, prothoracic setae; i, terminal segments; j-k, pupa: j, cephalothorax and metanotum; k, abdomen.

AËDES ANDERSONI Edwards.

Andersonia tasmaniensis, Strickland, 1911, *Entom.*, 44: 250. *Aëdes andersoni* Edwards, 1926, *Bull. Ent. Res.*, 17: 112.

Distinctive Characters. Adult: Scutum with median area of small dark bronze scales broadening on posterior half and contrasting with broad margin of creamy scales. In front of wing roots large patch of broad white scales (typical form) or long narrow pale scales in place of it (Grampians form). Hind femora mottled. Male terminalia: Coxite without long dense mesially-directed setae. Basal lobe shelf-like having on its margin one short stout seta, one long stout seta with recurved tip, 10-14 long finer setae with recurved tips, remainder finer. Larva: Head seta 5, 3-5-branched; 6, 2-4-branched. Prothoracic setae: 1, 2 and 6, single; 3, 4 and 5, 2-branched; 7, 2-3-branched. Lateral comb patch of 24-33 fringed scales, central tooth twice as long as two nearest lateral ones. Siphon index 3.2-4.0. Pecten of 24-37 close-set strong spines.

Description of Adult. Male. Head: Vertex clothed with curved and forked creamy scales, lateral scales broad white. Torus dark. Palps as long as proboscis, excluding labella, dark-scaled. Proboscis black-scaled. Thorax: Integument dark brown. Scutal scales narrow curved; broad median stripe of small dark bronze scales between dorso-central bristles broadening on posterior half in direction of wing roots; a very narrow stripe of goldish or creamy scales along acrostichal bristles. Broad lateral border of larger white or creamy scales in fossa, extending back towards wing roots. Large patch of broad white scales in front of wing roots. Scutellum with narrow curved creamy scales. Anterior pronotum with elongate and broad pale scales and dark bristles. Posterior pronotum with narrow curved and broader elongate dark and a few pale scales. Post-spiracular area with broad and elongate white scales and pale bristles. 4-6 lower mesepimeral bristles. Legs: All femora mottled. Fore and mid tibiae black anteriorly, with a few white scales, white-scaled posteriorly. Hind tibia black anteriorly with wide, white streak, pale posteriorly, except for black apex. Tarsi dark, unbanded; first segment of fore and mid legs with a few pale scales, first segment of hind tarsi mottled on basal three-quarters. All tarsal claws toothed. Wing length 4.6-5.5 mm. Cell R_2 1.4 times its stem. Abdomen: Tergites black-scaled, with white lateral patches. First tergite with median patch of pale scales, second with basal patch. Venter white-scaled with small central and larger apical lateral black patches. Terminalia (Fig. 6, *a*, *b*, *c*): Coxite dark-scaled laterally and sternally, with numerous long and short setae; only a few moderately long setae directed mesially. Apical and basal lobe prominent. Apical lobe with a few short setae. Basal lobe shelf-like with several moderately long setae on its upper surface and having on its margin one short stout seta, one long stout seta with recurved tip, 10-14 long finer setae with recurved tips, remainder finer. Style slender curved, tapering on distal third with 3 preapical setae; appendage slender almost straight. Harpago stout curved with slightly developed thumb near base of appendage, and a few scattered setae; appendage lanceolate as long as harpago. Lobes of IXth tergite with 3-7 short strong setae.

Female. Differs from male as follows: Head: Elongate patches of narrow bronzy scales close to posterior margin of eyes. Upright scales become dark laterally and towards neck. Lateral flat white scales with round dark patch medially. Torus with a few elongate pale scales above and black hairs mesially. Palps one-fifth length of proboscis, black-scaled, sometimes with a few pale scales. Thorax: Posterior pronotum with narrow curved white scales below, sometimes with some broader elongate scales; narrow curved and elongate, dark, almost black scales medially; narrow curved creamy scales above. Mottling on femora variable. Wing length 5.6-5.8 mm. Cell R_2 2.0-2.3 times its stem. Abdomen: Patch of scales on first tergite may be pale or dark; basal pale patch of second tergite may not be present.

Variability. The specimens from Tasmania, Flinders I., Wilson's Promontory and Lower Tarwin, Victoria, do not show much variation in colour; a patch of broad white scales in front of the wing roots is always present. Specimens from south-western

Victoria show a great deal of variation in colour and in size of the patch of broad white scales; many specimens have narrow curved scales in place of the broad ones. They also show greater variability in the mottling of the hind femur. Usually the basal half can be described as white with black mottling, the distal half as black with white mottling.

Larva (Fig. 6, *d, f, e, g*). Head, siphon and saddle light brown. Head three-fifths as long as broad. Antennae almost half length of head, with scattered spicules; seta 1 arising at about mid length, 5-6-branched. Head seta 4, tiny, 2-4-branched; 5, 3-5-branched, usually 4-branched; 6, usually 3-branched, rarely 2- or 4-branched; 7, 5-7-branched; 8, single; 9, 1-2-branched. Mentum with a median and 11-12 lateral teeth on each side. Thorax: Prothoracic setae: 1, 2 and 6, single; 3, 4 and 5, 2-branched; 7, 2-3-branched. Abdomen: VIIIth segment: Lateral comb a patch of 24-33 fringed scales, central tooth twice as long as two nearest lateral ones. Seta 1, 5-6-branched; 2, 2-3-branched; 3, 9-10-branched; 4, 2-branched; 5, 7-8-branched; seta 3 plumose, all others simple. Siphon tapering towards apex; index 3.2-4.0, mean 3.7. Pecten on basal half of siphon of 24-37 (mean 31) close-set, strong dark spines paler towards tip. Seta 1 arising at three-fifths length from base, 4-9-branched, plumose. Anal segment: Saddle covering dorsal half of segment, with coarse denticles on surface of dorso-distal part. Small elongate sclerotized plate lies near lower proximal angle of saddle. Seta 1 single, about as long as saddle; 2, 9-11-branched; 3, single; 4 (ventral brush), of 18-19 tufts, 2 of them usually precratal. Anal papillae equal, pointed, less than half length of saddle.

Pupa (Fig. 6, *h, j*). The pupa of *andersoni* possesses two main features which distinguish it from the pupae of the other six species reviewed in this paper, viz.: The trumpet has a row of short setae along the posterior side and seta 5 of abdominal segments 4, 5 and 6 is single.

Grampians form of *AËDES ANDERSONI* Edwards.

Specimens of *AË. andersoni* from Grampians, Victoria, agree in general with *andersoni* from Wilson's Promontory, but have no patch of broad white scales in front of wing roots. In addition this form differs as follows: Posterior pronotum with white elongate scales below, narrow curved and elongate pale-goldish scales medially and narrow curved pale scales above. May be goldish scales along acrostichal bristles on scutum. Cell R_2 of female wing 2.5-2.8 times its stem. Pale scales on tibiae arranged in longitudinal stripe. First segment of tarsi of all legs mottled with pale scales, particularly those of hind legs, which almost entirely pale. 2-4 lower mesepimeral bristles. Tergites 2 and 3 with trace of basal band.

Biology. Breeding places of *AË. andersoni* are confined to sparse woodland and particularly to tea-tree scrub. Larvae have been found in clean shallow road-side ditches and excavations as well as in pools of different sizes. At Wilson's Promontory, it usually breeds in peat swamps in which the water is dark coloured by decayed moss. The adults appear as early as September and continue their biting activity through to autumn; biting females have been collected in March. Larvae of *andersoni* are associated with *luteifemur*, *continentalis*, *alboannulatus*, and sometimes with *flavifrons* and *AË. (Pseudokusea)* sp.

Biting Habits. It is a day-biting mosquito that attacks men, rabbits and birds (hens).

Distribution. The typical form of *AË. andersoni* occurs in a coastal belt of Victoria about 20-30 miles wide and is very common on Flinders I. and in Tasmania. The form, described above as the "Grampians form", is known from three isolated localities: the Grampians (N. V. Dobrotworsky) and Bright (K. Meyers), both in Victoria, and Kiandra (I. M. Mackerras and H. J. Willings) in New South Wales. Specimens have been examined from the following localities: VICTORIA: Wilson's Promontory, Tarwin Lower, Colac, Carpendeit, Cape Otway, Homerton, Gorae West, Timboon (N. V. Dobrotworsky). FLINDERS I.: Lady Barron and Razorback (F. N. Ratcliffe, J. H. Callaby and D. L. McIntosh). TASMANIA: Boystown Res. (I. C. R. Rowley); Port Davey (E. N. Marks); Mt. Field Nat. Pk., Lake St. Clair (T. E. Woodward).

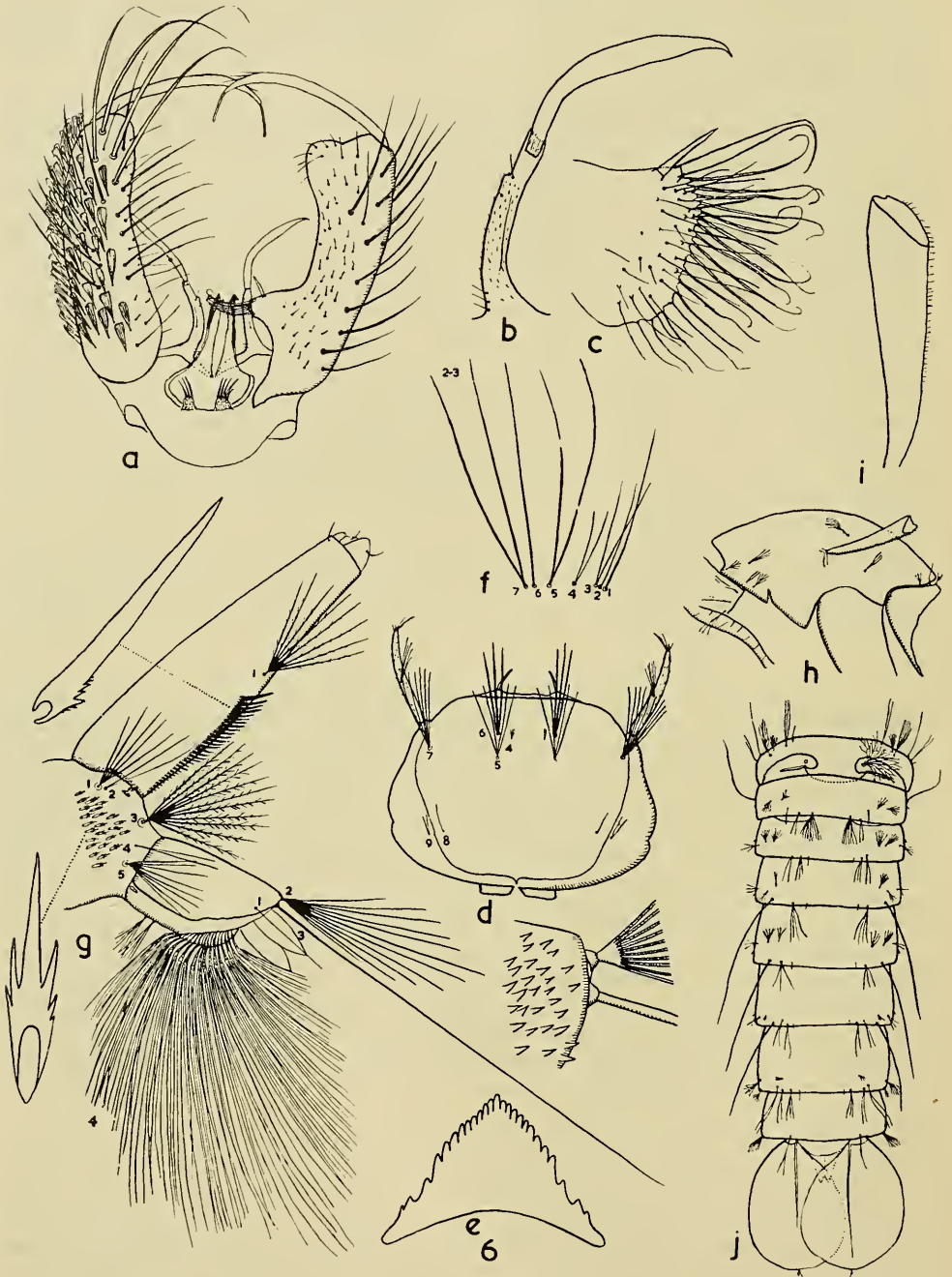


Fig. 6.—*Aedes andersoni* Edwards. *a-c*, ♂ terminalia: *a*, left coxite sternal aspect, right coxite tergal aspect; *b*, harpago; *c*, basal lobe; *d-g*, larva: *d*, head; *e*, mentum; *f*, prothoracic setae; *g*, terminal segments; *h-j*, pupa: *h*, cephalothorax and metanotum; *i*, trumpet; *j*, abdomen.

Discussion. Of the two forms of *andersoni*, the typical one alone is found in Tasmania, Flinders I., and the coastal parts of southern Gippsland (Wilson's Promontory—Tarwin Lower). The Grampians form, alone, in three isolated areas on the Dividing Range. However, a mixed population of both forms and also intermediates (which have only a few broad white scales in front of the wing roots) occurs in the Western District south of the 38th latitudes. This mixed population appears to be isolated from the Gippsland population and from the Grampians population.

AÈDES CONTINENTALIS, n. sp.

Types. The type series were bred from larvae and pupae collected at Carpendeit, Victoria, 24.9.58. One paratype male and three paratype females have their associated larval and pupal skins. The holotype male, allotype female, four paratype males and four paratype females are in the collections of the National Museum, Melbourne. One paratype male and one paratype female are in each of the following collections: C.S.I.R.O., Division of Entomology, Canberra; School of Public Health and Tropical Medicine, Sydney; University of Queensland, Brisbane; British Museum (Natural History), London; U.S. National Museum, Washington.

Distinctive Characters. Adults: Proboscis mottled on basal half. Scutum uniformly clothed with narrow curved golden scales. All femora mottled. First segment of tarsi of all legs mottled. Male terminalia: Coxite without dense long hairs directed medially. Basal lobe shelf-like, having on its margin 2 or 1 short spine-like setae and 12–14 long setae, most of them recurved. Larva: Head seta 5, 3–4-branched; 6, 3-branched. Prothoracic setae 1 and 2, single; 3, 2-branched; 4, 5 and 6, single; 7, 2–3-branched. Siphon index 4.0–5.0. Pecten of 25–35 strong closely set spines. Spines on surface of saddle coarse and irregular on dorso-distal part. Anal papillae equal, broad, about one-third length of saddle.

Holotype Male. Head: Vertex clothed with narrow curved and forked creamy scales. Lateral scales broad flat creamy. Proboscis mottled with creamy scales on basal half. Palps mainly dark-scaled, segments 2 and 3 with creamy scales at base, 4 and 5 with a few pale scales at base. Palps slightly longer than proboscis with labella. Thorax: Integument brown. Scutum uniformly clothed with narrow curved golden scales, becoming paler around bare area. No bronze scales on fossa. Scutellum with narrow curved pale scales. Anterior pronotum with dorsal patch of narrow curved goldish scales, broader scales medially, and black and pale strong bristles. Posterior pronotum with small patch of curved pale scales below, elongate dark and pale scales medially, narrow curved pale scales above. Post-spiracular area with patch of mainly narrow and a few broader, pale scales. 3–4 lower mesepimeral bristles. Legs: All femora mottled anteriorly and pale-scaled posteriorly. Knee spots inconspicuous. Fore and mid tibiae mottled anteriorly, hind tibia black dorsally with some mottling near apex. Tarsi black-scaled, unbanded, with first segment of all legs and base of 2nd segment of hind legs mottled. All claws with tooth. Wing length 5.2 mm. Cell R_2 1.2 length of its stem. Knob of halteres pale-scaled. Abdomen: Tergites black-scaled; first segment with a few pale and dark scales; 2–7 with white basal bands joining lateral spots. Sternites white-scaled with median and apical lateral, black spots on 2–7 segments. Terminalia (Fig. 7, *a, b, c*): Coxite dark-scaled sternally and laterally with some white scales at base: strong setae apically and several moderately long, and some short setae along inner edge of coxite; tergally with numerous short fine setae along inner aspect, long and strong setae laterally. Apical lobe prominent, with a few fine setae. Basal lobe shelf-like, having on its margin 2 short spine-like setae and 12–14 long setae, most of them recurved; upper surface with several fine setae. Style about half length of coxite, curved, with 3–4 short fine preapical setae; terminal appendage slightly curved. Harpago stout, with a few short setae near base; appendage widening gradually toward half length and then tapering gradually towards tip. Paraproct with single tooth. Lobes of IXth tergite with 3–5 short, stout setae.

Paratype Males. The chief variations shown in a series of 9 males are: The length of the wing varies from 4.7 to 5.3 mm. In some specimens the proboscis is less mottled and the palps have fewer pale scales than in the holotype. Some specimens have only 2 lower mesepimeral bristles. Degree of mottling of legs varies only slightly. The tergal bands may be greatly reduced and sometimes absent. The black patches on the sternites may be expanded, reducing the white-scaled area to two lateral longitudinal patches. Basal lobe of coxite may have only one short stout seta instead of two.

Allotype Female. Differs from holotype male as follows: Forked scales on vertex become black laterally and towards neck. Proboscis extensively mottled on basal three-quarters. Palps one-fifth length of proboscis, mottled with creamy scales. Torus ochreous, dark in medial aspect, with a few black hairs and pale scales. Posterior pronotum medially black-scaled. Scales on post-spiracular area mostly narrow. Three strong lower mesepimeral bristles. First two tarsal segments extensively mottled with creamy scales; base of third segment with some pale scales. Claws on all legs toothed. Wing length 4.7 mm. Cell R_2 1.8 times its stem. Knobs of halteres pale-scaled with some black scales below. Basal bands complete only on tergites 4 and 5, reduced on 2nd to a few pale scales, and on 3rd and 6th to a median patch of pale scales.

Paratype Females. The chief variations shown in a series of 9 females are: Length of wing varies from 4.5 to 5.0 mm. In some specimens the tergal bands are reduced to a few pale scales. Sternites 3 and 4 may be mottled.

Larva (Fig. 7, *f, h, g, i*). Head, siphon and saddle light brown. Head about two-thirds as long as broad. Antenna almost half length of head; seta 1, arising at about midlength, 4-5-branched. Head seta 4, small, 2-4-branched; 5, usually 3-, may be 4-branched; 6, 3-branched; 7, 5-7-branched; 8 and 9, single or 2-branched. Mentum with small median and 11-12 lateral teeth. Thorax: Prothoracic setae: 1 and 2, single; 3, 2-branched; 4, 5 and 6, single; 7, 2- may be 3-branched. Abdomen: VIIIth segment: lateral comb patch of 24-32 fringed scales, central tooth twice as long as two nearest lateral, or longer. Seta 1, 5-6-branched; 2 and 4, single; 3, 6-11-branched; 5, 4-6-branched. Seta 1, slightly fringed; 3, fringed; other simple. Siphon tapering towards apex, index 4.0-5.0, mean 4.5. Pecten on basal half of siphon of 25-35 strong closely set, dark spines with pale tips and 4-5 denticles at base. Seta 1 arising slightly beyond mid length of siphon, 5-7-branched. Anal segment: Saddle covering dorsal three-quarters of segment, surface with coarse irregular denticles on dorso-distal part; small separate elongate sclerotized plate lies near lower proximal angle of saddle. Seta 1 and 3, single; seta 2, 5-7-branched; 4 (ventral brush), of 16-19 tufts, 2-4 of them precratal. Anal papillae equal, broad, about one-third length of saddle.

Pupa. Details shown in figure 7, *j, k*.

Biology. *Aë. continentalis* have been found breeding in rain-water pools and small swamps with grassy edges, exposed to the sun. Fourth stage larvae have been collected as early as September. The larvae have been found associated with larvae of *Aë. andersoni*, *luteifemur*, *alboannulatus*, *queenslandis* and *C. fergusonii* (at Maroondah). The adults have been collected during November-February. It is not a very common species and during the past few years has been numerous only at Maroondah.

Biting Habits. It is a day-biting mosquito.

Distribution. The distribution is similar to that of *andersoni*, but it has not been collected farther than 40 miles from the coast. Its range extends to East Gippsland, South Australia and Flinders I., but apparently it is absent from Tasmania. Specimens have been examined from the following localities: VICTORIA: Cabbage Tree Creek, Wilson's Promontory, Tarwin Lower, Maroondah, Yellingbo, Carpendeit, Hamerton, Gorae West (N. V. Dobrotworsky), Colac (F. G. Tighe); S.A.: Shallbank, Lake Bonney Millicent, Robe, Narrabarra (E. W. L. Lines); FLINDERS I.: Razor Back (J. H. Calaby and D. L. McIntosh), Lady Barron (F. N. Ratcliffe).

CLASSIFICATION.

Of the seven species considered here, three, namely, *cunabulanus*, *andersoni* and *continentalis*, belong to the *Cunabulanus* Section as defined by Marks (1957).

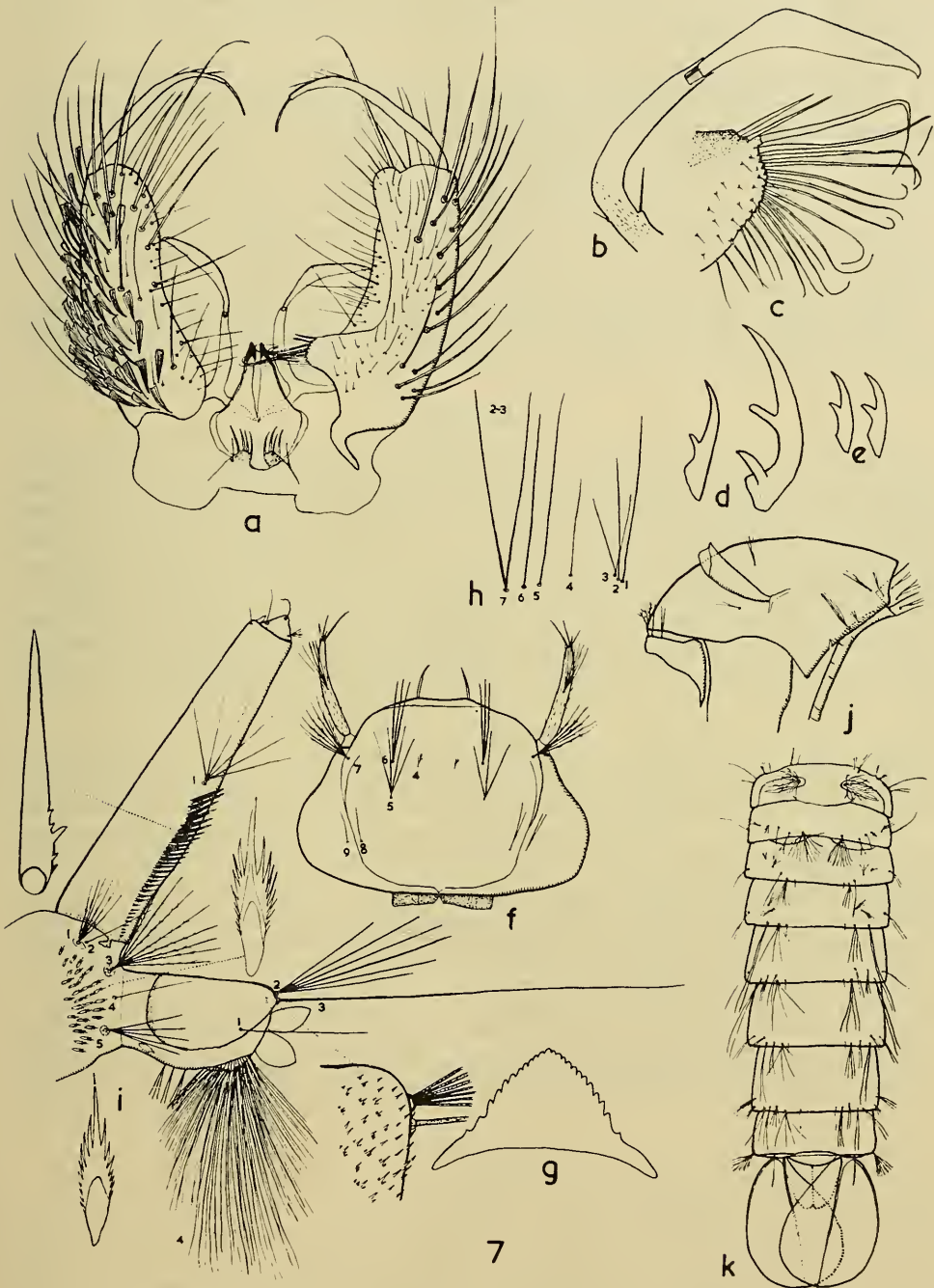


Fig. 7.—*Aedes continentalis*, n. sp. a-c, ♂ terminalia: a, left coxite sternal aspect, right coxite tergal aspect; b, harpago; c, basal lobe; d-e, ♂ tarsal claws: d, fore; e, hind; f-i, larva: f, head; g, mentum; h, prothoracic setae; i, terminal segments; j-k, pupa: j, cephalothorax and metanotum; k, abdomen.

Of the remaining four species, *camptorhynchus* and *nivalis* were placed by Marks in the *Camptorhynchus* Section, while *luteifemur* and *waterhousei* would fall into the *Perkinsi* Section. However, their separation into two sections does not seem to be justified.

The main character for distinguishing between members of the *Camptorhynchus* and *Perkinsi* Sections, as defined by Marks, is the structure of the marginal setae on the basal lobe of the coxite: in *Camptorhynchus* Section there is a single long strong recurved seta; in the *Perkinsi* Section there are several such setae. However, in respect of this feature the four species listed above form a series: *camptorhynchus* with one strong recurved seta, *nivalis* with one similar seta followed by four long fine setae with recurved tips, *luteifemur* with the first seta more slender and the following setae only slightly finer than first, and *waterhousei* with 5-6 equally strong recurved setae.

The larvae of these species do not have any traits which would support a division into two sections, and for these reasons it is proposed to unite the *Camptorhynchus* Section and *Perkinsi* Section under the name *Perkinsi* Section.

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